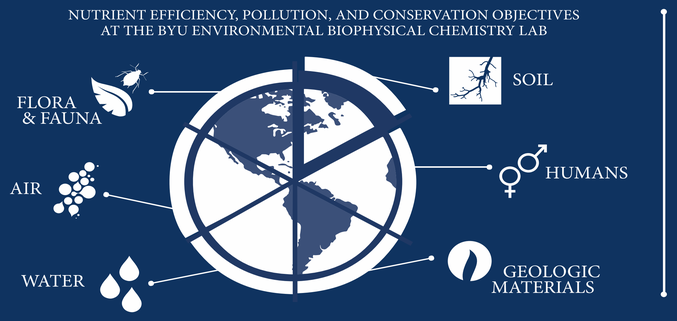

Polyacrylamide for Increasing Soil Moisture and Seeding Success

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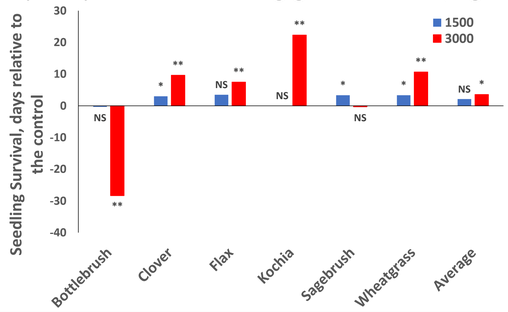
GLOBAL OBJECTIVES

- CONSERVE SOIL VIA VEGETATIVE COVER
- MEET USAF DEFENSE GOALS WHILE PROTECTING ENVIRONMENT
- IMPROVE RANGE CONDITIONS FOR PLANT & ANIMAL HEALTH
- REDUCE WATER EROSON AND CONTAMINATION
- REDUCE WIND EROSION AND CONTAMINATION

Introduction

- US Air Force (USAF) uses live munitions on the desert range (UTTR) west of Salt Lake City often causing wildfire.
- Committed to ecological restoration on lands damaged by resultant fire.
- Cheatgrass (*Bromus tectorum* L.) is an invasive species that inhibits establishment of other range species—degrading forage quality and potentially increasing fire risk.
- Revegetation is a challenge due to low annual precipitation of ~25 cm.
- Polyacrylamide (PAM) is a super absorbent compound used in agriculture as a soil conditioner.
- Preliminary study showed that PAM could be used to enhance seedling survival under conditions of no precipitation following germination (Fig. 1).

Fig. 1. Number of days seedlings stayed alive with 0, 1500, or 3000 kg PAM ha^{-1} treatment. Bars with a "" signify that they are statistically greater than the other treatments for that species.*



Materials and Methods

- Nine 0.13 m^2 boxes were filled with loam soil from the UTTR (Fig.2a.).
- A planting furrow was created with 0.04 m peak height (Fig. 2b.).
- Bands of PAM were applied in the furrow valley 0.08 m below the soil surface (Fig 2b.) with treatments of 0, 20, and 40 g PAM box^{-1} (0, 1500, and 3000 kg ha^{-1}, respectively).
- Soil was watered once to saturation at planting.
- Seeds of six species (Fig. 2a) were planted perpendicular to the furrow immediately after saturation such that seedling emergence/viability and soil moisture could be evaluated daily at three locations (peak, slope, and valley; Fig. 2a.).

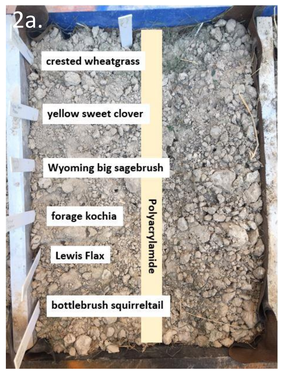


Fig. 2a. Overhead view of the planting box.

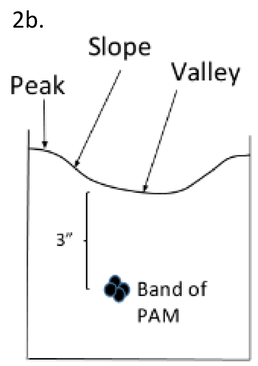


Fig. 2b. Cross sectional view of the planting box.

Results

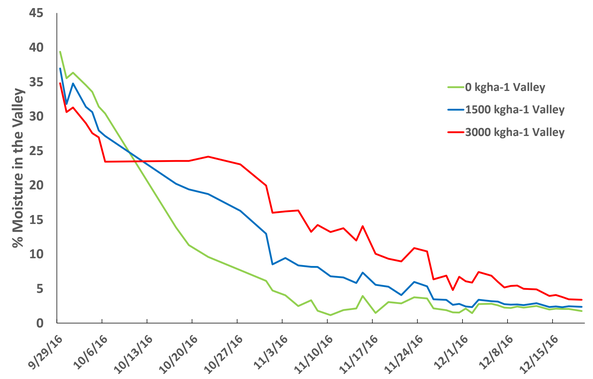


Fig. 3. Volumetric soil water content in the PAM band (valley) for 0, 1500, and 3000 kg PAM ha^{-1}.

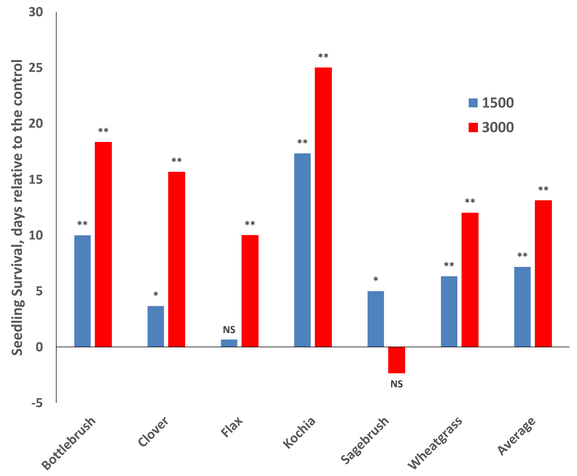


*Fig. 4. Increase/Decrease in seedling survival for 0, 1500, and 3000 kg PAM ha^{-1}. Significance is indicated with a "**" for P<0.01, "*" for P<0.05, and "NS" for not significant.*

- Soil moisture in the PAM band (valley) was retained at 3000 > 1500 > 0 kg PAM ha^{-1} beginning 10/15 through approximately 11/20 and 12/10 for the 1500 and 3000 kg treatments, respectively (Fig. 3). There were no statistically different soil moisture values for the peak or the slope (data not shown).
- In contrast to the preliminary study (Fig. 1), all species showed an increase in seedling survival under drought conditions with PAM application (Fig. 4); response varied according to PAM rate.
- The effect was minimal on the slope and greatest in the valley, but some differences were also noted at the furrow peak (data not shown).
- Curiously, there was no effect for sagebrush at the high rate, despite being significant at the low rate (Fig. 4).

Conclusions

- PAM does increase soil moisture significantly as a function of rate. Future studies need to be done to determine the ideal rate.
- Increase in soil moisture due to PAM does increase seedling survival under drought conditions. If the number of seedlings germinated increases, then seeding rate may need to be decreased to avoid a negative impact with regard to water depletion in the rooting zone.
- Further work needs to be done to verify these results in field conditions, as well as to explore if the effect of PAM at the high rate for sagebrush was an anomaly or if there is some toxicity.

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